SOFT ELEMENT – DECISION REASONING FRAMEWORK FOR GREEN DEVELOPMENT PROJECTS

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SOFT ELEMENT-DECISION REASONING FRAMEWORK FOR GREEN DEVELOPMENT PROJECTS

by

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DEDICATION

This thesis is dedicated to my beloved Babah and Mama, my siblings Along and Apan, and my significant other, Raja Mazrul Kamarulzaman who believed in me and provided me all the support I need throughout this journey.

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LIST OF ABBREVIATIONS

SE	Soft Elements
GBI	Green Building Index
MYCREST	Malaysian Carbon Reduction and Environmental Sustainability Tool
REDHA	Real Estate Housing Developers Association Malaysia
CIDB	Construction Industry Development Board, Malaysia
JKR	Jabatan Kerja Raya (Public Works Department)
NGTP	National Green Technology Policy
GTFS	Green Technology Financing Scheme
NPCC	National Policy on Climate Change
RE	Renewable energy
EE	energy efficiency
GEO	Green Energy Office
MGTC	Malaysian Green Technology Corporation
KeTTHA	Ministry of Energy, Green Technology and Water
AFFIRM	Awareness, Faculty, Finance, Infrastructure, Research and Marketing

RANGKA KERJA *‘SOFT ELEMENT’* – PENENTU KEPUTUSAN UNTUK PEMBANGUNAN PROJEK HIJAU

ABSTRAK

Soft element (SE) adalah berkait dengan aspek pentadbiran dalam menggerakkan projek secara berkesan. Walaupun SE ini lebih kecil dari segi peratusan di dalam kewangan berbanding *hard element*, namun peranannya adalah kritikal untuk pengurusan dan pengawasan pelaksanaan projek untuk memastikan persediaan projek yang berkesan. Oleh kerana SE ini adalah bersifat tersirat, mengaitkan elemen ini secara langsung kepada keputusan projek adalah sukar. Kajian ini bertujuan membangunkan sebuah rangka kerja yang menunjukkan SE secara holistic dan menerangkan bagaimana ianya memberi kesan terhadap keputusan projek binaan. Dalam menyediakan rangka kerja ini, teori *‘Resource Mobilization’* dan *‘Rational Choice’* telah digunakan sebagai asas. Kajian ini juga menggariskan definisi SE dengan jelas dan mengenalpasti faktor-faktor penentu rasionalisasi pilihan dalam membuat keputusan. Teknik kualitatif rekabentuk penyelidikan dua peringkat telah digunapakai: 1) temuduga awalan dengan 5 panel pakar dan 2) temuduga mendalam dengan 38 responden yang terdiri daripada arkitek dan jurutera. Terdapat 3 kategori utama SE yang telah dikenalpasti: Pengaruh Rekabentuk, Keperluan Badan Berkuasa, dan Peruntukan Pembangunan, dengan 9 elemen. Dari kajian Peringkat 1, penemuan kajian mengesahkan bahawa arkitek dan jurutera bertanggungjawab untuk merasionalkan keputusan mengenai SE di mana pemikiran logik mereka dipamerkan melalui peranan mereka. Kajian itu mendapati 5 peranan berkaitan dengan SE seperti, menentukan penyelesaian reka bentuk, meyakinkan klien, memuaskan sya yarat perancangan, mengekalkan kualiti

bangunan hijau, dan memastikan pensijilan hijau dapat dicapai. Kajian itu juga mengenal pasti 17 faktor penentu yang memberi kesan terhadap keputusan berkaitan dengan SE, yang membawa kepada 21 hasil keputusan. Kajian ini membolehkan pemahaman yang jelas dan komprehensif mengenai SE, dari definasinya kepada impaknya terhadap pelaksanaan projek dan pengaruhnya dalam keputusan projek. Tesis ini menyumbang secara teori, metodologi dan praktikal kepada badan pengetahuan dalam bangunan hijau.

SOFT ELEMENT – DECISION REASONING FRAMEWORK FOR GREEN DEVELOPMENT PROJECTS

ABSTRACT

Soft element (SE) relates to administrative aspects that are responsible for effective project mobilization. Although SEs are comparatively smaller in monetary percentage than hard elements, their role is critical to the management and control of project implementation and ensures the effective delivery of construction on site. As the nature of SE is elusive, relating elements of this nature directly to project decision is difficult. This research aims to develop a framework providing holistic representation of SE and explain how they affect project decisions. In developing this framework, the Resource Mobilization Theory and Rational Choice Theory are used as the underlying theories. The study also outlines a clear definition of SE and identifies the reasoning factors rationalising decision-making. A two-tier research design is adopted using qualitative technique: 1) preliminary interview with 5 expert panels and 2) in-depth interview with 38 respondents consisting of architects and engineers. It was discovered that there are 3 main categories of SE namely, Design Influence, Authority Requirements, and Development Provisions, with 9 elements. From Tier 1 study, the findings confirmed that architects and engineers were responsible for rationalizing decisions concerning SE in which their logics are expressed through characterisation of their role. The study found 5 roles in relation to SE i.e. determining design solutions, persuading the client, ensuring compliance with planning conditions, maintaining green qualities, and ensuring green certification is achievable. The study also identified 17 reasoning factors that affect decisions relating to SE, which lead to 21 decision outcomes. The research establishes a clear

and comprehensive understanding of SE from its description to its impact on project implementation and influence on decision-making. This thesis contributes theoretically, methodologically and practically to the body of knowledge in green building.

CHAPTER 1

INTRODUCTION

1.1 Introduction

This chapter provides an overview of the research topic and introduces fundamental issues that raised interest in the area of study. It lays the contextual background, elucidates the research problem, raises questions needing answers, draws the aim and objectives of the study, defines the scope of research, informs the contributions of the study, and describes the methodology of which the study embarks. The thesis outline presents a general description of the research structure for the remaining chapters.

1.2 Background of Research

Urbanisation is taking place all over the world. In the 1900s only 13% of the world's population lived in urban areas; now more than half of the planet's population live in cities. At such high density, these highly populated areas consume 75% of non-renewable resources and produce excessive amounts of pollution. It is anticipated that in several years, the world population will increase near half fold from 7 billion to 9.5 billion people, and that 70% of them will be living in urban areas (Alyami & Rezgui, 2012). These staggering facts mean that continuing our rate of resource consumption will leave the planet dry in the near future. Construction solutions need to become much smarter in order to accommodate the growing population while controlling the rate of resource depletion.

With the growing human population and thriving industrial development taking place all over the world, Earth's natural resources are depleting three times faster than it should and expected to run out by year 2030 (TheWorldCounts, 2014; Guardian, 2008). Rapid construction increases the consumption of energy sources leading to higher levels of greenhouse gas emission into the atmosphere (Tisdell, 2008; Lindner, *et al.*, 2010). This will affect Earth's climate in various ways including variations in surface temperatures, fluctuating patterns of rainfall, increased intensity of drought, mounting sea levels, and more excessive meteorological irregularities such as flooding and extreme tropical cyclones (Fuhrer, et al., 2006; Mann, 2009; Morabito, et al., 2012).

The building industry is the largest energy consumer taking 50% of primary energy sources globally (Zaid & Graham, 2009). With the perpetual population growth, rapid building development, increasing human activity time indoors, and rising demand for improved building services and user comfort, means that this figure is expected to increase (Pérez-Lombard, Ortiz, & Pout, 2008). Construction activities run the risk of environmental degradation such as disturbance to ecosystems, human health, water and agricultural resources, (Mann, 2009; Morabito *et al.*, 2012). Economists have analysed that this will have significant negative impacts on economic expansion (Tisdell, 2008).

As a developing third world country, the construction industry in Malaysia has continued to sustain a strong momentum of construction development activities. Apart from being the fastest growing economic sector in 2015 with a chartered annual growth rate (CAGR) of 11% in the five-year period (EPU, 2010), the new 11th Malaysia Plan (2016 – 2020) has also made a salient point to re-engineer economic growth through industrial transformation that includes amplifying the construction industry's circa growth by an additional 16% (EPU, 2015).

In an effort to achieve this plan, the construction industry risks the impact of urban sprawl to the environment such as depletion of natural resources, environmental pollution, traffic congestion, brown field areas, loss of inner city attractions, infrastructure decay, lack of social amenities and material waste generation (National Urbanisation Policy, 2006). In addition, Malaysia's rapid urbanisation led to an unsustainable pattern of building energy consumption (Abdul-Aziz & Ofori, 2012), which contributed to escalated levels of carbon emissions by 235% in less than 20 years (Energy Commission, 2011).

Realizing the cumulative adverse effects of construction, activists and government bodies all over the world have advocated the goal to reduce global greenhouse emissions and the need for change in construction practices (William & Daire, 2007; Mann, 2009). The need to improve building energy performance is now intensified and an effective solution is required. The problem was first recognized in the seminal 1987 Brundtland Report, which highlighted the need for balance between physical development and environmental sustainability (WCED, 1987; WGBC, 2009). This has encouraged the implementation of green buildings worldwide (Fullbrook, Jackson, & Finlay, 2006; UNFCCC, 2007; WGBC, 2009).

Green buildings are believed to offer a range of benefits including long-term cost savings, increased business efficiency, improved indoor ambience and employee wellbeing, enhanced organizational image, and environmental preservation to name a few (Kats G. H., 2008; Rashid, Spreckelmeyer, & Angrisano, 2012; Liang *et al.*, 2014). They provide a conducive environment for building users to enjoy a better quality of life that is both economically efficient and socially healthy while minimising pollution and resource depletion (Hussein, 2009; Liang *et al.*, 2014). Green building is quickly becoming an important trend in the building industry market with Europe and North America leading the way. While the green building trend has matured in Europe and North American markets, the trend in other developing countries in Asia such as Middle East and North Africa regions is still growing in their percentage of green market share, some holding an average of 39 percent of green share in the building industry (World Green Building Trends, 2016).

Malaysia has also joined this global effort to support green development. Efforts to address sustainability issues in Malaysia's built environment was first observed in the 7th Malaysia Plan (1996-2000) (Van Der Akker, 2008; Abdul-Aziz & Ofori, 2012). Since then, Malaysia's commitment to sustainability is demonstrated through government initiatives in the form of policies, regulations and economic instruments (GBI, 2009; Sood & Peng, 2011; MIDA, 2012; Abdul-Aziz & Ofori, 2012). The efforts were motivated by Malaysia's energy consumption increasing 1.5% for every 1% increase in GDP (R.Saidur, 2009) whereby 94% of that energy is generated from fossil fuels (Mohammad, *et al.*, 2014). With the nation's developing status prompting more and more construction activity, the situation proves to be unsustainable. In 2014, Malaysia showed an increase in greenhouse gas emission by 221% which contributes to 0.69% of the world's total emission and places Malaysia among the top 30 countries of gas emitters (Islam, Ahmed & Mahmudul, 2013; Zain, Hassan, Majid & Balubaida, 2014). Thus, green development was promoted as a way to improve energy efficiency. Considering this, a reassessment of the building envelope design that catered to the local climatic conditions was fundamental to reduce the energy demand in buildings (Yang, Lam, & Tsang, 2008; Shaikh, *et al.*, 2017).

However, previous studies show that the battle for green development in Malaysia is currently still in its developing stage (Abidin, 2010; Azizi, et al., 2013;

Bohari, Skitmore, Xia & Teo, 2017). Although the Government of Malaysia has shown political support for greening the built environment, actual implementation of green practices in the construction industry has been limited by conflicting cost challenges (Sim & Putuhena, 2015; MyGreenTech, 2010). This is largely due to the colossal cost involved in the project capital of green building projects, which has been widely cited as the biggest obstacle in green development (Sim & Putuhena, 2015; Ping & Chen, 2016; Bohari, *et al.*, 2017). While a number of studies have refuted this claim, a large majority of industry practitioners remain skeptical (Sonagar & Fieldson, 2008; Bordass, 2012; Bond & Perrett, 2012).

Previous researches have focussed on hard building elements to explain cost premiums in green buildings such as structural and technological ramifications to meet green certification standards, but provided no conclusive answer (Dwaikat & Ali, 2016). Scholars debate the range of cost premiums from less than zero to over 20 percent (Dwaikat & Ali, 2016), which raises the question, why do some projects cost less or more than their conventional counterparts? The research seeks to answer why such variations occur. To answer this question, one must look into the management and delivery of green building projects (soft elements) such as what decisions were made, how they were made and why in order to discern the real dynamics impacting project cost. For example, what motivates a decision to apply for platinum rating over green certified in green building projects? What impacts does this decision have on the project?

Soft elements, which are responsible for administering a project forward remain hidden in the project but bear a significant role in ensuring that the movement towards green is effective and holistic. This is achieved through managing project decisions. Given that critical decisions made at the outset of the project, particularly during design stage, are most critical in determining the project outcome, it is important to understand rationalizations of those decisions and their impact on project implementation. Therefore, soft elements, which concern the elusive and administrative bearings of a project, are explored in this thesis.

1.3 Research Problem

According to the World Green Building Council, buildings are primarily responsible for a third of the global carbon emissions. Growing concern for environmental issues due to construction activities have led to the rise of green building concept worldwide (Fullbrook *et al.* 2006; WGBC, 2009). The penetration of green development in Malaysia's construction industry was received and supported by the government through various initiatives, policies and programs (Chua & Oh, 2011). In response to the emerging market for green development in Malaysia, the private sector led by the Malaysian Architects Association (PAM) established its own rating tool in 2009 that took into consideration the local environment, climate and practices (GBI, 2012). Admiring such progress, the outlook of green building development in Malaysia looked promising.

However, the reality is that while an increasing number of projects are heeding the green movement, the number of establishments going for green certification is less than satisafactory (Samari, Ghodrati, Esmaeilifar, Orfat & Wira, 2013). Research found that majority of construction establishments in Malaysia were reluctant to participate in green building adoption and preferred to continue building using conventional methods (Abidin, 2010; Samari, *et al.*, 2013; Mydin, Phius, Sani & Tawil, 2014, Bohari, *et al.*, 2017). Scholars have found that the resistance is explained by the additional cost expected in green building projects that was a primary stumbling block for many establishments (Shafii *et al.*, 2006; Bandy, *et al.*, 2007; Langdon, 2007; Kibert, 2008; Yudelson, 2008; Shari, *et al.,* 2009; Abidin, 2010; Sood & Peng, 2011; Zhang *et al.*, 2011; Bond & Perrett, 2012; Hwang & Tan, 2012; Sim & Putuhena, 2015; Ping & Chen, 2016; Bohari, *et al*., 2017). The cost premium found in green building projects are often due to expensive green materials specified, green rating certification, and the extra costs incurred searching for green product alternatives. In addition, the complex requirements of green building often require specialized consultants to be engaged (Häkkinena & Bellonia, 2011; Yudelson, 2009; Langdon, 2007). With green certification in view, systems that do not achieve the specified green standards also need to be corrected at a cost (Hwang & Tan, 2012). Although previous scholars have proven that sustainable projects can be economically viable (Hydes & Creech, 2000; Yates, 2001; Pettifer, 2004), the increased development cost for green buildings impose a perturbing financial risk (Esa *et al.,* 2011).

To refute this, many research have demonstrated the clear long-term benefits of green buildings from all economic, social, and environmental aspects (Kats G. H., 2008; Chua & Oh, 2011; Mekala, Jones, & MacDonald, 2015, Balaban & Puppim de Oliveira, 2016). Nevertheless, it appears that the market readiness level in Malaysia remains below average (Abdullah, 2012; Sood & Peng, 2011; Chua & Oh, 2011; Samari *et al.,* 2013; Esa *et al.,* 2011; Ministry Of Finance Malaysia, 2010; Sahid *et al.,* 2011; Abidin, 2010; Hashim & Ho, 2011). Bohari, *et al.* (2017) conducted an intensive review of empirical findings published in the literature body on green building cost premiums and found conflicting evidence of projects costing equal, if not less than their conventional counterparts, and projects costing more than 20 percent more than their conventional counterparts. The disparity of findings in literature and reality show that green building benefits do not outweigh economic concerns. The conflicting empirical findings of green building cost premiums further exacerbate the confusion.

It was apparent that people in general did not understand what exactly constitutes cost. It is important to understand cost aspects and its impact to better plan for cost control. However, previous cost studies have focused on hard elements of construction and dismiss the importance of soft elements. Soft elements are crucial because they are responsible for effectively managing the project forward. Thus, decisions related to soft elements have a domino effect on hard elements. Literature shows that cost barriers are reinforced by 'soft' aspects such as marketing drives, availability of government incentives and policies, and the market readiness (Colliver, 2007; Kubba, 2012). Shen, *et al.* (2017) revealedthat positive green practices by green advocates are often impeded by the lack of support from organisation managements (Shen, Zhang & Long, 2017).

Abidin (2010) found that the level of acceptance of sustainability among the Malaysian property developers is low, especially those from small and medium companies who represent the majority of the market population. This is attributed to developers' lack of knowledge, poor legislation enforcement, lack of experience in sustainable practices, and the passive culture of developers. In real estate business, choices for moving forward are largely motivated by the primary goal to generate maximum profit at the least cost (Diyana & Abidin, 2013). Research showed that the cost premium of green buildings can be as low as 0-2% for basic green certified buildings to over 7% for more sophisticated buildings (CBRE, 2009). The higher initial cost and associated risks in green building projects discourage organisations from voluntarily entering the green building market (Qian, Chan & Khalid, 2015).

For many profit-seeking organisations, the benefits offered and return of investment (ROI) must coincide with the cost of adhering to green certification requirements for the project to be attractive (Shafii, *et al.;* Ali, & Othman; 2006; Poveda & Young, 2015). Thus, despite the various efforts to drive forward the sustainability agenda through introduction of incentives and policies, green building development in Malaysia has been moderate and purely a voluntary approach (Abidin, 2010; Esa *et al.*, 2011; Hashim & Ho, 2011).

Although green certified buildings had the ability to boost an organization's image and attract premium rentals, the decision to proceed with the project was still subject to whether the perceived costs outweighed the benefits (BEE, 2010; Urbecon, 2008; Pierce, 2008; Riesa, Bileca, Gokhanb & Needy, 2006). Therefore, monetary incentives were desirable to help alleviate financial outlays through tax exemption/abatement, fee reduction/waiver, grants and revolving loan funds for green projects (Häkkinena & Bellonia, 2011; USGBC, 2011). However, Bond & Perrett (2012) asserted that political incentives are not significant enough to change the behaviour of construction practitioners in embracing green practices and urged that more effective measures were needed to investigate the underlying reasons behind rational decisions in construction practice.

Chan, *et al.* (2009) reminded that the construction projects involve various limitations in resources, which often dictate choices of commitment to projects as they struggle to optimize and mobilize limited resources for multiple project needs. Hence, projects normally give way to strategic and tactical business priorities, which imply committing to the bare minimum of authority requirements and regulations for them to acquire the necessary development order (D.O.) and move on to maximize yield (Chan, *et al.*, 2009; Hoffman & Henn, 2008).

However, Hoffman & Henn (2008) stressed that social and psychological barriers of construction practitioners were the true inhibiters of green development. In order to move forward, it was evident that change was indispensable in these respects (Bond & Perrett, 2012). As social and psychological expressions are elusive in nature, they demonstrate a form of 'soft' element. These 'soft' inhibitions may influence crucial decisions made in the choice to implement green building projects, which lead to cost concerns. To control project cost, it is important to properly manage these soft aspects during critical planning stage (Azizi, Abidin & Nuruddin, 2013). Colliver (2007) and Cupido, et al. (2010) highlighted that if not managed well, soft elements can impose various financial risks related to designing, permitting, and certifying processes of the project execution that lead to expensive delays.

The Pareto principle was founded by an Italian economist, Vilfredo Pareto who discovered that 80% of Italy's wealth was owned by 20% of its population (Bunkley, 2008). Following this example, it asserts that for most cases, 80 percent of outputs or outcomes come from 20 percent of the inputs or causes (Koch, 2011). Although economists commonly use the Pareto principle for devising marketing strategies, it can be universally applied to any context (Stephens, 2005). Maintaining this principle in construction context means that a vital few of the project constituents contribute to the bulk of the project cost. It is well known in project management that 20 percent of the work (the first 10 percent and the last 10 percent) consume 80 percent of the project time and resources (Stan, 2010; Skytt, 2013).

Therefore, by manipulating these vital few would provide huge impacts to the project entirety. A study by Victoria, *et al.* (2017) discovered that substructure, frame and services were the most significant building elements that were responsible for over 70 percent of the total capital cost. However, the cost may vary between buildings due to differences in design and specification (Victoria, Perera, Davies & Fernando, 2017). The finding reveals that, while specific elements evidently represented the majority of capital cost in a project, the design and specification of those elements were fundamentally responsible for the ultimate cost outcome. Thus, it is worth exploring the process of design and specification through the lens of the building designers to uncover their cognitive realities. The tangible cost of managing design and specification is small on paper. However, the effect that it produces to the project far outweighs any other measures of cost. The design process is a valuable instrument in the project that can influence 80 percent of the project output. As a result, inputs within the design process are vital measures to determine the project direction. Seeing that the design process is the setting up phase in the project delivery course, many critical decisions are made at this juncture. It is therefore important to monitor these decisions and understand how they are considered.

Soft elements, which are the elusive aspects associated with facilitating project completion, may influence hard elements of a building project despite being small in perspective of cost (Colliver, 2007; Cupido, 2010; Azizi, Fassman & Wilkinson, 2010; Azizi, *et al.*, 2013). While SEs quantify a small fraction of project cost, SEs underlay decisions leading to the outcome of hard costs (e.g. substructure, frame, and services). Using the principle of Pareto Law, the outcome of project cost is the result of how SEs affect decisions for the design and specification of building elements. Hence, the Pareto principle inspired the research agenda of exploring how soft elements affect project outcome.

As soft elements refer to the managerial part of project execution, it is important to clarify what constitutes these element, which raises the question: what are the ‘soft’ elements in a building project regulating project direction? How do these elements influence choices for project completion? The research intends to fill this knowledge gap by identifying these elements in a green building project and elucidating how they influence decisions in the project delivery.

The motivation of this research was to better understand cost-related challenges of green building projects. The gaps discussed in the problem statement indicate the need to identify soft elements and ascertain how they influence the implementation of green building projects. Limited researches have explored the soft part of cost considerations in green projects. Most scholarly findings focus on tangible building construction costs, but do not analyse the understated soft elements at project execution level. The literature implies that, as soft elements constitute the fundamental administration aspects to drive a project forward, it is important to identify these elements and determine the extent to which they impact project delivery. Issues surrounding soft elements could influence choices made within the project, which in turn affect the successful rendition of green projects on site. Recognizing these issues can help determine the current direction of green movement in Malaysia and establish measures to tackle soft cost challenges in green building projects. Hence, the research will address the following research questions.

1. What constitutes soft elements in construction projects?
2. Why are design consultants important in managing soft elements?

3. How do soft elements influence project decision?

1.4 Aim and Objectives of Research

This research aims to develop a model illustrating soft elements and their influence on project decision. This model is later named as Soft Element – Decision Reasoning model. To achieve this aim, the following objectives are outlined.

i) To determine the soft elements relevant in green building projects

ii) To examine the role of design consultants in relation to soft elements

To relate the decision outcomes with reasoning factors of soft elements

1.5 Scope of Research

The area of study is confined to the context of Malaysia construction industry only. Although green building adoption has been well encouraged in Malaysia, the actual implementation in industry is found to be limited. Scholarly findings have repeatedly revealed expensive cost premiums as a primary barrier in green building implementation. To comprehend the whys and wherefores of these cost premiums, explanations must be sought from those who have experience and knowledge in green building projects. For this reason, purposive sampling is adopted to gather informants who fit the purpose of the investigation. The research focussed on the stakeholders who have direct influence and jurisdiction in construction project decisions. While generalisability or representativeness cannot be achieved through purposive sampling, proportionality is not the main concern but rather, rich insight into the research problem. Expert sampling and homogenous purposive sampling is used in stage 1 and 2 of the enquiry.

The scope of the research centres on realizing the impact of SEs on the outcomes of a green building project. Hence, enquiries are directed to learn the fundamental reasons that explain practical decisions pertaining green building project cost. The classification of SEs into three different categories allowed the range of study to be narrowed down to a defined scope. Elements that fall outside these three categories do not form part of this study.

1.6 Contribution of Research

This thesis contributes in two categories i.e. theoretically and practically to the advancement of knowledge in green building research.

Theoretically, the research proposes a model illustrating the soft cost elements that affect decision-making in green projects. The model helps to strengthen understanding of the challenges faced in mobilizing green building projects in Malaysia by revealing the underlying 'soft' elements that influence project decisions. Although cost of green building has often been studied in green building research, the aspect of 'soft' cost has not been sufficiently analysed. Thus, important differences in findings of past cost studies on green development projects have not been examined. This research uses the Resource Mobilization Theory and Rational Choice Theory to introduce a new theory, the Soft Element – Decision Reasoning Theory. The theory purports that the implementation of green building projects is mobilized by the involvement of key parties who manage the 'soft' elements of the project that influence rational choice in assessing project decision – wherein, these soft elements are influenced by a range of factors. Academics may benefit from this model for further research on 'soft' elements affecting decision reasoning in project mobilization. Academics may also use the Soft Element – Decision Reasoning Theory in other contexts as a basis of their research framework.

Based on the theory, a model was constructed presenting the soft cost elements that lead to the assessment of project decisions and demonstrating how the architect and engineer rationalize decisions that project mobilization. Practically, the model can be used as a reference for construction practitioners to realize the soft elements affecting decision-making of the design consultants concerning mobilizing action for green building projects. To understand the impact of soft cost elements on the project, construction practitioners can examine the reasoning factors and decision outcomes of each element. To address any concerns related to a soft cost element, construction practitioners can then re-evaluate the relevant roles connected to that element. To understand the impact of soft cost elements on the project, construction practitioners can examine the reasoning factors and decision outcomes of each element. To address any concerns related to a soft cost element, construction practitioners can then re-evaluate the relevant roles connected to that element.

1.7 Terminologies Adopted

This section defines the list of terminologies adopted in this research.

i) **Green Development Project:** A development project proposed for construction with the intention of achieving a green rating. Development refers to a wider spectrum of activities at the strategic and tactical level of project execution. The term development is used to encompass activities within the pre-construction and post-construction stages. Green development project provides a holistic way of describing various facets of the project evolution.

ii) **Green building:** A building either residential or commercial that considers and addresses environmental interests in its development.

iii) **Soft Elements (SE):** Elements that are abstract and administrative that help drive the project forward.

iv) **Soft cost**: Costs that are the result of soft elements.

v) **Hard elements:** Elements related to physical activities and materials used in building construction.

1.8 Research Methodology

Research methodology describes an all-embracing strategic process governed by sound principles and valid assumptions that are recognized and appropriate for various schools of research (O'Leary, 2010). As the nature of the research problem seeks to explain the whys and wherefores of a practical issue, emphasis is placed on an exploratory and explanatory qualitative enquiry, which requires a subjective measurement tool such as in-depth interviews. In-depth interviews allow for rich descriptive data that provide deeper and broader insights into the investigation (Creswell, 2003, Babbie, 1990).

The study was conducted in two stages. Tier 1 study with a panel of industry experts was performed at the early stage to become better inform ed about the research topic, and endorse the viability and appropriateness of the research dimensions used in the enquiry. It also helped to shape the research questions and research design. A panel of four suitable construction industry experts were selected using expert sampling to review the initial SE framework and to build on knowledge of the current industry's state of affairs. The preliminary study adopted an unstructured interview approach as the aim of the enquiry was more of fact-finding and needed a style that was flexible. This allowed verification of the concepts representing SE as applied in industry and identification of new elements that were not included in the first theoretical SE framework. During the interviews, cost datasheets were shared by the interviewees and used to verify the soft cost elements through documentary analysis.

Tier 2 study of the research developed the findings obtained from Stage 1 and probed into a deeper level of understanding about soft costs to explain how they affected project outcome. The findings from this phase conveyed a rich data source and constructed new interpretations of green building cost. Semi-structured interviews were used at this stage to define more structure around the enquiries whilst maintaining a degree of flexibility.

Salkind (2009) stated that interviews are an excellent tool for extracting implicit information that are otherwise difficult to access, such as feelings, experiences, and opinions (Salkind, 2009). Interviews are also used to approach hard-to-reach groups of people that form a minute of the mass population such as busy experts who possess a lot of implicit knowledge (Flick, 2014). Implicit information can be made explicit through transcribing narratives of the interview responses gained. As the existing body of literature offered little information on the research subject, detailed insights were required from relevant individuals and thus, substantiated the use of interviews in both stages of the study.

The academic theories underpinning the research concept are the relative Resource Mobilization Theory and Rational Choice Theory. The theories support the formulation of a new conceptual theory, which establishes the theme of the research. Through literature review, the research topic was tapered to a smaller focus surrounding soft costs before progressing to empirical work. Empirical findings from the fieldwork shaped the discovery of the soft cost effect theory. Table 1.1 shows the research design used to meet the research objectives.

Table 1.1 Research design used to meet research objectives

Stage	Research Method	Research Objectives	Research Question
Tier 1	Formulation of conceptual theory; preliminary interview; cost datasheet	i) To determine the soft elements relevant in green building projects	What constitutes soft elements in construction projects?
Tier 2	In depth interview	ii) To examine the role of design consultants in relation to soft elements	Why are design consultants important in managing soft elements?
		iii) To relate the decision outcomes with reasoning factors of soft elements	How do soft elements influence project decision?

1.9 Thesis outline

The format of this thesis is following the Universiti Sains Malaysia thesis guideline. The thesis comprises of eight chapters.

Chapter 1 introduced the research by describing the background of study, explaining the research problem, establishing the research aim and objectives, outlining the scope of research, highlighting the research contributions, defining the terminologies used, informing the research methodology and presenting the research outline of which the thesis will follow.

Chapter 2 provides a comprehensive review of the literature that are relevant to the research objectives. This includes scholarly writings on cost of green building versus conventional building, and discussions on hard and soft cost elements. This chapter aims to provide insight into the definition of soft cost, description of soft elements (SEs), factors affecting SE, factors influenced by SEs, and developers' consideration of SEs in the decision to implement green building.

Chapter 3 discusses the theoretical development that underpins the research construct. It presents the fundamental theories adopted in a composite system and establishes the relationship between the theories. This is used to build the theoretical framework of the study and present a conceptual model for the research to follow.

Chapter 4 describes the research methodology used to achieve the research objectives of this study, along with methods of data collection and analysis tools. It explains the philosophical assumption, research paradigm and methodological configuration embraced to execute the study. The chapter also confirms the reliability and validity of the empirical findings and outlines the area of research.

Chapter 5 presents the results and analysis of the empirical data from Tier 1 study. It outlines the definition of soft cost and identifies the elements that fit its definition. The elements are sorted into categories that represent similar types of elements. It also identifies the parties involved in stimulating actions related to SEs.

Chapter 6 presents the results and analysis of the empirical data from Tier 2 study. It demonstrates how meaning is construed from the practical findings into plausible codes, which are collated into relevant categories. A decision tree was developed to explain how green strategies can be derived. The analysis presents results for three research components i.e. roles of design consultant, reasoning factors, and decision outcomes.

Chapter 7 provides discussion of the research findings from the overall study according to the categories of SE. It shows the development of the Soft Element – Decision Reasoning Model and its interpretation from the research findings.

Chapter 8 records concluding remarks on the study and draws on recommendations that underpin the achievement of research aim and objectives. It also outlines the implications of the research for the future of green development in Malaysia.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

Chapter 2 provides a review on green building development in the construction industry. It examines the genesis of green building concept in relation to construction and highlights the importance of soft aspects in green project development.

2.2 The Emergence of Green Concept in Construction Industry

2.2.1 Construction Industry and Environmental Issues

The construction industry is an important economic contributor and regulator for other industries (Myers, 2013). However, it is also known for its significant carbon footprint and exploitation of natural resources, accounting for 30-40% of the world's primary energy (Chong, *et al.,* 2009; Ding, 2008; Lee & Yik, 2004; Son, Kim, Chong, & Chou, 2011; Tan, Shen, & Yao, 2011; UNEP, 2007). In view of the problem, the concept of green building was introduced as part of the environmental movement to mitigate global issues of exhaustion of natural resources, extreme climate change, and destruction to the environment (Owens & Legere, 2015). Various industries have adopted sustainable practices including manufacturing, construction, marketing, tourism, and food industry. Over the years, these issues have intensified at alarming rates and triggered increasing concern worldwide (Alyami & Rezgui, 2012). The United Nations Environmental Program (UNEP) anticipated a 50% increase in primary energy use from 2005 to 2030, flagging an urgent need for immediate action to provide an effective solution (UNEP, 2007).

In view of the problem, the green movement aims to transform the conventional market to a greener market. However, this remains a slow process and one that faces various difficulties compared to other industries (Myers, 2005). In order to understand these difficulties, it is essential to grasp the concept of green building and how it has evolved. The research philosophy and conceptual framework is also presented here, that explains the direction in which the study shall be undertaken.

2.2.2 Green Concept in Construction Industry

Environmental enthusiasts have long debated on environmental issues resulting from the rapid growth of the building industry. Following this, green building concept was introduced to help minimize the impact of construction on its environmental surrounding and promote a sustainable environment for the future generation. The most frequently quoted and universally accepted definition of sustainable development came from the Brundtland Report, which defined green building as a "development that meets the needs of the present without compromising the ability of future generations to meet their own needs." The definition was endorsed by the UN World Summit on Social Development in Rio de Janiero in 1992, who affirmed that "economic development, social development and environmental protection are interdependent and mutually reinforcing components" (WCED, 1987). The definition encompasses the important concepts of sustainability which include eradicating deprivation, preserving the wellbeing of natural resources, and stimulating growth of economy and society. Green buildings were introduced as part of the sustainability agenda to promote a healthy building system that confirmed with the concepts of sustainability. In order to achieve this, it is important that the effort garnered the relevant support from building stakeholders by achieving an equilibrium between environmental, economic and social needs (UNCED, 1992).

In 2002, the World Summit on Sustainable Development established three key objectives of sustainable development, which are to eradicate poverty, protect natural resources, and amend unsustainable productions and consumption patterns (Wedding & Crawford-Brown, 2007). The Governor's Green Government Council (GGGC) described green building as “a building whose construction and lifetime operation assure the healthiest possible environment while representing the most efficient and least disruptive use of land, water, energy and resources.” (GGGC, 2010). The U.S. Environmental Protection Agency (2012) explained green buildings as “the practice of creating structures and using processes that are environmentally responsible and resource-efficient throughout a building's life-cycle from siting to design, construction, operation, maintenance, renovation and deconstruction.” CCE Tompkins (2012) classified green building as a structure put together from healthy materials that minimizes waste and environmental impact, while maximizing functionality and efficiency. It takes into consideration the place, design, process and lifespan of the building. The Green Building Index defined green buildings as a building that optimizes the efficient use of resources while reducing building impact on human health and environment during the building’s lifecycle (GBI Organisation, 2012). Generally, green buildings are intended to address three major issues i.e. people’s entitilement to justice and rights; elimination of environmental degradation; and protecting future generations from impoverishment as a consequence of today’s actions (Redclift, 1987; Sood & Peng, 2011).

The definitions in literature is consistent in its approach to interpret green building. All definitions pivot around the same fundamental concept, which is to offer a healthy building that sustains the needs of both humans and the environment over time. Hence, this concept has been globally accepted and supported by building environmentalists in the interest of safeguarding Earth's natural resources through buildings that are environmentally friendly.

2.3 Green Development Project

2.3.1 Definitions

Green development and green construction are often confused terminologies as their differences between definitions is loose and ambiguous. Construction is often perceived by industry players as covering only those activities on site (Goh, 2014). Du Plessis and Presley & Meade provided a more holistic definition of construction encompassing site activity, project cycle, construction business, and the broader process of human settlement creation (Du Plessis, 2007; Presley & Meade, 2010). The contradiction of definitions has led to confusion in interpretations.

Development, on the other hand, is a more elusive concept and can be evasive and misleading in its flexible definition. However, most texts of development refer to a wider spectrum of activities at the strategic and tactical level of project execution (Crush, 1995). The term development is used to encompass activities within the pre-construction and post-construction stages. Green development provides a holistic way of describing various facets of the project evolution (Campbell, 1996).

2.3.2 The Importance of Green Development

The 3rd Annual Regional Conference on Green Tech Asia in 2012 presented that buildings consume 32 percent of the world's resources, including 12 percent of its water and up to 40 percent of its energy which accounts for 40 percent of the world's greenhouse emissions. Green construction is believed to help address a